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CIVILIAN CRANIOCEREBRAL GUNSHOT WOUNDS IN BASRAH

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ABSTRACT

Background

Gunshot wounds are most common penetrating head injuries in the civilian setting in Iraq. Although, they are highly lethal and some patients need urgent neurosurgical care, the majority of them carry good prognosis.

Aim

To determine factors, which affect the outcome of patients with craniocerebral gunshot injury.

Patients and Method

A prospective study on 144 surgically treated gunshot penetrating head injured patients in Alsedir Teaching Hospital between June 2007 – June 2011 was carried out. After resuscitation a neurological examination was done and the injured patients were classified according to severity using Glasgow Coma Scale (GCS) into mild injury (score 13-15), Moderate injury (score 9-12) and Severe injury (score 8 -6). CT scans were performed on all patients to determine intracranial lesions.

Results

112 of the patients were males and 32 females. Forty-four percent of patients' age was between 16-30 years. The most frequent site of the bullet entrance was on right side in 112 patients. Neurological signs include 24 patients had motor weakness, and 8 patients had dilated pupil. CT findings include 24 patients had ICH, 24 patients had SDH, 16 patients had IVH and 116 patients had less than 3 injured lobes. Accidental injury occurred in100 patients. Postoperative complications are stitch abscess in 16 patients, hydrocephaly in 8 patients and cerebrospinal fluid fistula in 8 patients. Hundred patients had good outcome while 20 patients died within 48 hours postoperatively.

Conclusions

Factors seem to be associated with prognoses are GCS, the site of bullet entrance, some CT findings, dilated pupil, and the underlying events.

KEYWORDS: Craniocerebral, Glasgow Coma Scale (GCS), Gunshot, Injuries, Basra

INTRODUCTION

Gun control opponents like to say, "Guns do not kill people, people ki ll people". But people with guns kill people much more often and efficiently than people without guns [(1)]. Cranial gunshot wounds often result in severe injury to the brain and related central nervous system (CNS) structures [(2, 3, 4, 5)].

Penetrating Cranial gunshot wounds are insults in which scalp, cranium, and, to a varying degree, dura and brain are traversed by a foreign body [5, 6]. Such wounds can be classified as tangential, perforating, or penetrating. Penetrating gunshot wounds, especially those that cross the coronal or midline sagittal planes, are usually fatal [3, 8, 9, 10].

In missile wounds, the amount of damage to the brain depends on a number of factors including (1) the kinetic energy imparted, (2) the trajectory of the missile and bone fragments through the brain, (3) intracranial pressure (ICP) changes at the moment of impact, and (4) secondary mechanisms of injury [11].

The goals of surgery for cranial missile wounds are removal of intracranial hematomas and necrotic or contused brain causing mass effect, removal of accessible bone and metal fragments, and debridement of entrance and exit wounds [9, 11, 12, 13].

The outcome of which can be anything from complete recovery to permanent disability or death. Mild and moderate TBI may also cause a host of temporary or permanent physical, cognitive, emotional and social problems [14].

AIM

To determine factors that affect prognosis of patients with craniocerebral gunshot injury.

PATIENTS AND METHOD

This is a comparative study, which was conducted on 144 surgically treated patients with gunshot penetrating cranial wounds, whom were presented to the Basrah Alsedir Teaching Hospital between May 2006 and March 2008 with GCS of 6 -15.

All patients included in this study underwent neurological examination. Patients under effect of drugs, toxins, or associated systemic injuries were excluded from the study. The severity of injured patients classified according to GCS (16):

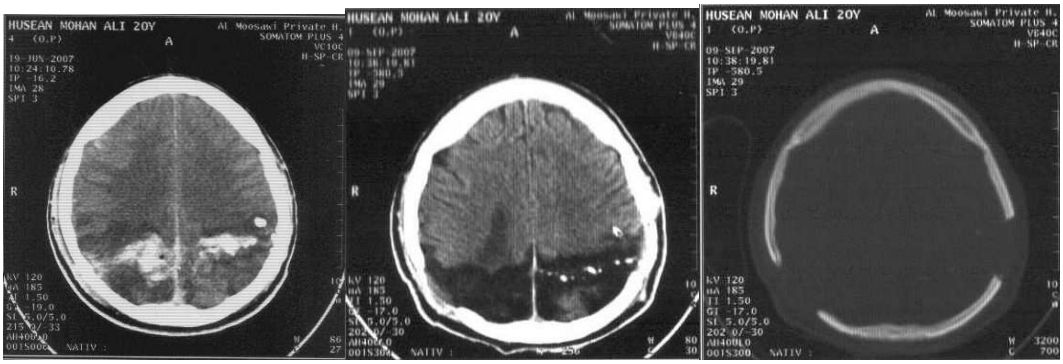
- Mild injury includes patients with a score of 13-15
- Moderate injury includes patients with a score of 9-12
- Severe injury includes patients with a score 6- 8

Computerized tomography scans were performed on all patients to show intraventricular haemorrage (IVH), intracerebral hematoma (ICH), subdural hematoma (SDH) and tract contusion.

All patients admitted to the hospital and underwent surgical intervention within the 1st 24 hours included removal of intracranial hematomas and necrotic or contused brain causing mass effect, removal of accessible bone and metal fragments, and debridement of entrance wounds. All of them received prophylactic antibiotics and anticonvulsant agents and the outcome was based on neurological evaluations and classified according to the GCS into:

- Good recovery: patients return to preinjury level of function
- Moderate disability: patients ended with neurological deficits but were able to look after self
- Vegetative state: patients were unable to look after self

- Death



A B C

Figure 1: Cranial CTs of a Patient with Penetrated Gunshot Wounds Involving Both Lobes, the Patient was Survive Without Neurological Deficit. A - CTs before Surgery, B - CTs after Surgery and C- CTs Bone Window after Surgery

RESULTS

Table 1: Distribution of Study Population According to Age

Age Group/Year	Number of Cases	Percentage	Severity of Injuries		
			Mild	Moderate	Severe
1 – 15	28	19.44	8	16	4
16 – 30	64	44.44	24	12	28
31 – 45	36	25.00	12	8	16
46 – 60	16	11.11	8	8	0
Total	144	100.00	52	44	48

P-value= 0.0001

Table 2: Distribution of Study Population According to Gender

Gender	Number of Cases	Percentage	Severity of Injuries		
			Mild	Moderate	Severe
Male	112	77.8	32	32	48
Female	32	22.2	20	12	0
Total	144	100	52	44	48

P-value= 0.0001

The male: female ratio equal to 3.5:1

Table 3: Distribution of Study Population According to Sits of Gunshot Entrance

Sit of Entrance	Number of Cases	Percentage	Severity of Injuries		
			Mild	Moderate	Severe
Right frontal	24	17	16	8	0
Right parietal	32	23	8	8	16
Right temporal	40	27	8	12	20
Right occipital	16	11	12	4	0
Left frontal	16	11	8	8	0
Left parietal	16	11	0	4	12
Total	**144**	**100**	**52**	**44**	**48**

P-value= 0.0001

Table 4: Distribution of Patients According to Preoperative Neurological Examination

Sign	Number of Cases	Percentage	Severity of Injuries	
			Non Severe	Severe
Motor weakness	24	17	12	12
Dilated pupil	8	5	0	8
Non*	112	78	84	28
Total	**144**		**96**	**48**

* No motor weakness or dilated pupil, P-value= 0.0001

Table 5: Distribution of Study Population According to CT Findings

CT Finding	Number of Cases	Percentage	Severity of Injuries	
			Non Severe	Severe
Tract contusion	70	58	56	14
IVH	22	5.5	17	5
SDH	18	16	3	15
SDH, IVH	9	3	2	7
ICH	20	16	15	5
Hydrocephaly	5	1.5	3	2
Total	**144**		**96**	**48**

P-value= 0.0001

Table 6: Distribution of Study Population According to Number of Injured Lobes

Number of the Lobes	Number of Cases	Percentage	Severity of Injuries		
			Mild	Moderate	Severe
1	64	45	40	16	8
2	52	36	12	28	12
3	12	8	0	0	12
Bihemispher	16	11	0	0	16
Total	**144**	**100**	**52**	**44**	**48**

P-value= 0.0001

There are 116 patients (81%) of the bullet injuries to less than 3 injured lobes and 36 patients (19%) with bihemispheric and 3 lobe injuries.

Table 7: Distribution of Study Population According to Causes

Causes	Number of Cases	Percentage	Severity of Injuries		
			Mild	Moderate	Severe
Assault	32	22	4	8	20
Robbery	12	8	0	4	8
Accident	100	70	48	32	20
Total	**144**	**100**	**52**	**44**	**48**

P-value= 0.0001

About 70% of the gunshot wounds occurred accidentally, 22% caused by assault and only 8% due to robbery.

Table 8: Distribution of Study Population According to Postoperative Complications

Complication	Number of Cases	Percentage
Fit	4	3
CSF leak	8	5.5

Stitch abscess	16	11
Pneumonia	12	8
Hydrocephaly	8	5.5
Total	**48**	

Postoperative complication stitch abscess are 11%, hydrocephaly are 5.5%. Exrtracranial complication (pneumonia) form 8%.

Table 9: Distribution of Study Population According to Length Hospital Stay

Length of Stay/ Week	Number of Cases	Percentage	Severity of Injuries		
			Mild	Moderate	Severe
Died	20	14	0	4	16
< 1	12	8	12	0	0
1-2	96	67	40	36	20
> 2	16	11	0	4	12
Total	144	100	52	44	48

P-value= 0.0001

Ninety-six patients (66%) stay in the hospital between 1 to 2 weeks, 8 patients (22%) stay less then one week and 4 patients (11%) stay more then 2 weeks.

Table 10: Distribution of Study Population According to Outcome

Severity of Injuries	Number of Cases	Result			
		Good recovery	Moderate disability	Severe disability	Died
Mild	52	52	0	0	0
Moderate	44	36	4	0	4
Severe	48	20	8	4	16
Total	**144**	**108**	**12**	**4**	20

P-value= 0.0001

The table shows good recovery in 108 patients (75%), low incidence in both moderate disability and severe disability, while only 20 patients (14%) died.

DISCUSSIONS

In five recent civilian series of cranial firearm injuries from the United States, including all age groups, the range of patients' age ranged from 26-35 years and 80-91% of the patients were males [7, 15, 16, 17]. Michael found that overall series composed of 89% male and 11% female patients [4, 7, 18, 19]. In the current study (table 1), 56 patients (44%) aged between16-30 years old, 28 of them had severe head injury. Thirty-six patients (25%) aged between 31-45 years old, 16 of them had severe head injury. Twenty-eight patients (19%) aged less than 15 years old, one of them had severe head injury. Sixteen patients (11%) aged more than 46 years old had not severe head injury. It is clear that age group is significantly associated to severity when the age group between the 15-30 years carries a high percentage of severe injuries (p=0.0001).

Table 2 show, the male patients were 112 (78%) and the female patients were 32 (22%). Male: female ratio of those less than 15 years old is 1.3:1 (which is nearly equal), while there is male predominance 4.3:1 in the young age group (16-30 years old). A statistically significant association can be noted when about half of male injuries were severe and non of females injuries carry such severity (P-value= 0.0001). From previous results, the severe injuries were seen in male young age group while the children and old age group had mild injuries. This could be explaining by:

- The young males are more involved in conflicts and daily activities, which render them more prone to various injury hazards.
- The most common cause of bullet injury in children and adult was “accidental” as compared to younger age, which was “assault event”.
- Children and old age group patients presented with severe injury might be dying immediately or had GCS below 6 that not included in this study.

Regarding missile wound entrance sites, Michael shows that 34% was frontal, 23% was temporal, 19% was parietal, and 20% was occipital. In this study (table 3), the gunshot entrance sites was 33% in the parietal, 27% in the frontal, 27% in the temporal and 11% in the occipital sites. It is also obvious that gunshot entrance was predominant in the right side of the skull 78% compared to 22% on the left side. There are a clear results the severity highly associated with left parietal entrance follow by Right parietal and temporal while non severity associated with other site of entrance (P-value= 0.0001). This can explain the Injuries to active brain area, left parietal follow right parietal and temporal consider a risk factor as compare with silent brain area frontal and occipital that associated with non severe injuries. The frontal region is the commonest site of entry in children, due to the fact that the frontal region is most exposed region in the supine position during sleeping in the outdoors.

Regarding the preoperative neurological examination, table 4 shows that dilated pupil is a statically significant sign (P-value= 0.0001) to determine the severity, less likely the motor weakness. This could be explained by the fact that most of the patients with dilated pupil have increased intracranial pressure, which leads to brain herniation, as compared to those patients with motor weakness those results from direct trauma to motor cortex.

Table 5 show a statistically significant the severity of injuries associated with SDH as compare with other CT scan, IVH, ICH and hydrocephaly associated with non severe injuries P-value= 0.0001. This might be due to CT scan finding, IVH, ICH and hydrocephaly can be surgically treated.

16 patients with bihemispheric wounds had severe head injury, table 6; 12 of them died. 12 patients with unilateral 3 injured lobes had severe head injuries, 4 of them died. 4 Patients with less than 3 injured lobes were died. Bihemisheric and 3 brain lobes injuries statistically significant associated with the severity while injuries to less than 3 brain lobes are less likely (P-value= 0.0001). This might indicated that the wide area of brain destruction was associated with bihemispheric and 3 lobe injuries.

Michael found that 52% of patients with gunshot injuries were due to armed robbery and others were due to assault (21%), suicide (19%), accident (3%), drug-related encounters (1%), police-related encounters (1%), and those occurring during random activities (3%) [(4)]. This study, table 7, shows high incidence of accidental gunshot wounds in 100 patients (70%), 20 of them had severe head injuries, 32 patients (22%) with assault events, 20 of them had severe head injuries while 12 patients with robbery events, 8 of them had severe head injuries. The high incidence of accidental gunshot wounds may be related to post-war events including guns abuse. The suicide attempts, which form a large percentage in most of the articles studied civilian craniocerebral gunshot wounds, were not found in the current study cases. This may be due to religious believe or death of patients before hospitalization. The severity of injuries statistically significant associated with robbery and assault cases rather than accidental cases (P-value= 0.0001). This might be far distance of gun causes loss of gun velocity (energy) when penetrated skull in accidental cases as compare with robbery and

assault cases.

The incidence of stitch abscess occurred in 11% (table 8) that may be due to use of bad material or low quality of sterilization. Hydrocephaly occurred in 5.5% of the patients; one of them developed hydrocephalous within the first weak; the other developed hydrocephalous after seven months of the injury. Both patients were improved after ventriculoperitonial shunting. Pneumonia developed in 8% of the patients in spite of using injectable antibiotics, which may be related to complications of general anesthesia rather than bacterial infection because it developed immediately after surgery. Single attack of focal fit occurred in 3% patients who were already on anticonvulsant drug and this might be due to their poor compliant. Eight patients developed posttraumatic rhinorrhoea within 48 hours postoperatively due to frontal sinus fracture. There was CSF leak in both patients, which stopped after 1 week of conservative measures.

Mean length of hospital stay was 7 days (range 1-17 days), Table 9 shows that 66% were in hospital between 1-2 weeks when patients usually wait until the time of stitches removal. It is a clear statistically significant that severity lead to died or long hospital staying rather than non severe cases with short hospital staying (P-value= 0.0001).

There are a high variability of the incidence of patients GCS that arrived to the hospital among main 6 studies on the civilian craniocerebral gunshot wounds [10, 20, 21, 22]. Michael found that the morbidity in 25% of the patients with severe head injuries had good outcome, 46% with moderate head injuries had good outcome, and 81% with mild head injuries had good outcome [4, 7, 18, 19]. While Benzel found the morbidity and mortality in the civilian gunshot head injuries (including patients with GCS less than 6) was 23% of the patients had good recovery, 16% were moderately disabled, 5% were severely disabled, and 56% died[5, 23, 24]. In this study, table 10 52 patients admitted to the causality had mild injuries, all of them good recovery. Forty-four patients with moderate injuries, 36 patients had good recovery, 4 patients had moderate disability and four of them died. Forty-eight patients admitted had severe injuries, 20 patients had good recovery, 8 patients had moderate disability, 4 patients had severe disability and 16 of them died. GCS statistically significant as a prognosis of severity of injuries while non severe case had good or moderate disability (P-value= 0.0001).

CONCLUSIONS

- Young males were more vulnerable to gunshot injury and many of them had severe head injury.
- Left parietal side followed by right temporal and parietal entrance sites carried worst prognosis than other sites.
- Dilated pupil is an important sign to determine the severity of injury, while the motor weakness alone does not indicate the severity and depends on the site of the injury.
- Subdural hematoma diagnosed by CT carried poor prognosis than intraventricular hemorrhage and intracerebral hematoma.
- Patients with bihemispheric or unilateral 3 or more injured lobes carried poor prognosis while those with less than 3 injured lobes carried good prognosis.
- Accidental gunshot wounds carry better prognosis than assault and robbery events.
- There are no obvious postoperative complications. Hydrocephaly when occurred, carried good outcome after ventriculoperitonial shunting.
- All patients with GCS 13-15 had good outcome. More than 80% of patients with GCS 9-12 had good outcome.

About 42% of patients with GCS 8 or less had good outcome, 33% of them died within 48 hours.

RECOMMENDATIONS

- In general, the craniocerebral gunshot injury is highly lethal but urgent neurosurgical care carried good prognosis to most of patients.
- Conduct systemic management of the patients before a neurosurgical examination
- CT scan must be done to all patients

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